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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/523,491	03/10/2000	Jason W. Klaus	UTC 003/9035	4903

7590

11/18/2002

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EXAMINER

FULLER, ERIC B

ART UNIT

PAPER NUMBER

1762

10

DATE MAILED: 11/18/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 09/523,491	<b>Applicant(s)</b> KLAUS ET AL.	
	<b>Examiner</b> Eric B Fuller	<b>Art Unit</b> 1762	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 10 March 2000.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-34 is/are pending in the application.
- 4a) Of the above claim(s) 25-34 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-24 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☒ Claim(s) 1-34 are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All   b) ☐ Some \*   c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                  | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____  |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                         | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>7</u> . | 6) <input type="checkbox"/> Other:  |

## DETAILED ACTION

### *Election/Restrictions*

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-24, drawn to a method, classified in class 427, subclass 250.
- II. Claims 25-34, drawn to a product, classified in class 428, subclass 450.

The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the product as claimed can be made by another and materially different process, such as the thin metal film layer can be formed by a chemical vapor deposition (CVD) method and later polished to achieve the claimed roughness parameters.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

Because these inventions are distinct for the reasons given above and the search required for Group I is not required for Group II, restriction for examination purposes as indicated is proper.

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During a telephone conversation with Mr. Gary C. Cohn on September 20, 2002 a provisional election was made with traverse to prosecute the invention of Group I, claims 1-24. Affirmation of this election must be made by applicant in replying to this Office action. Claims 25-34 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 3 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The phrase "the solid material" lacks antecedent basis. Additionally, this renders the claim confusing.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-5 are rejected under 35 U.S.C. 102(b) as being anticipated by Izumi (US 5,306,666).

Izumi teaches a process of forming a thin metal film on a substrate (abstract). Sequentially flowing tungsten hexafluoride, then a reducing gas, produces the tungsten film (column 2, lines 41-51; column 1, lines 65-68). The reaction is a binary reaction.

Claims 1-5, 7, 8, 11, and 14-16 are rejected under 35 U.S.C. 102(b) as being anticipated by Leem (US 6,143,659).

Leem teaches a process of coating forming a metal layer on a semiconductor surface (abstract). The process is formed by flowing a metal source gas, then sequentially flowing a reducing gas (figure 4) and repeated until the desire thickness is achieved. The metal source gas is an aluminum halide (column 2, lines 40-45). The reducing gas may be silane (table 2). The process is binary. Aluminum halides have a vapor pressure of above 0.1 torr at 100 degrees Celsius.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 7, 8, and 11-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Izumi (US 5,306,666).

Izumi teaches the above-mentioned limitations. Additionally it is taught that the substrate may be a semiconductor (column 10-25) and that the process is repeated until the desired thickness is achieved (figure 2). Tungsten hexafluoride would inherently have a vapor pressure of at least 0.1 torr at 100 degrees Celsius. The surface of the metal comprises a metal-metal halide surface during repetitions of the process (figure 3). The reference teaches to use hydrogen as the reducing gas (column 2, lines 45-51), and in doing so fails to teach using silane as the reducing gas in the sequential CVD process. However, the reference does teach that hydrogen is used because silane causes silicon contamination in the metal film, which can increase the resistivity and residual strain of the film (column 1, lines 50-55). It is also taught that there are benefits in using silane as the reducing gas, such as it allows for lower reaction (substrate) temperatures (column 1, lines 40-45). It is well known that semiconductor substrates are sensitive to high temperatures. Therefore it would have been obvious at the time the invention was made to a person having ordinary skill in the art, if resistivity and strain are of less concern than temperature, to use silane as the reducing gas in the process taught by Izumi. By doing so, lower substrate temperatures may be used.

Claims 17, and 19-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Leem (US 6,143,659).

Leem teaches the limitations shown above, but fails to teach that the halide is fluoride. However, it is the position of the examiner that since there are only 5 halides possible, to choose fluoride as the halide would have been obvious absence evidence of criticality.

Claims 6, 9, 10, 23, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Izumi (US 5,306,666) as applied to claims 1, 7, and 17 above, in further view of Pogge (US 5,681,775) and Humphery et al. (US 6,440,541 B1).

Izumi teaches, or makes obvious, the limitations of claims 1, 7, and 17. Izumi fails to teach that the substrate surface comprises hydroxide and that the silylating agent is flowed first. However, Pogge teaches that it is well known to hydroxilate the surface of semiconductor wafers in order to increase bonding (column 7, lines 12-20). To do so would have been obvious in order to increase the bonding of the metal layer with the substrate. By doing so, the surface of the substrate comprises hydroxide. Additionally, Humphrey teaches that silane may be used to increase the bonding between metals and hydroxides (column 3, lines 39-48). Therefore, it would have been obvious to flow silane onto the hydroxilated surface prior to the metal deposition step. By doing so, bonding is further increased.

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Claims 6, 9, 10, 23, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Leem (US 6,143,659) as applied to claims 1, 7, and 17 above, in further view of Pogge (US 5,681,775) and Humphery et al. (US 6,440,541 B1).

Leem teaches, or makes obvious, the limitations of claims 1, 7, and 17. Leem fails to teach that the substrate surface comprises hydroxide and that the silylating agent is flowed first. However, Pogge teaches that it is well known to hydroxilate the surface of semiconductor wafers in order to increase bonding (column 7, lines 12-20). To do so would have been obvious in order to increase the bonding of the metal layer with the substrate. By doing so, the surface of the substrate comprises hydroxide. Additionally, Humphrey teaches that silane may be used to increase the bonding between metals and hydroxides (column 3, lines 39-48). Therefore, it would have been obvious to flow silane onto the hydroxilated surface prior to the metal deposition step. By doing so, bonding is further increased.

### ***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Sneh (US 6,200,893) and Sherman (US 5,916,365) are relied on as they are pertinent to the applicant's disclosure.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eric B Fuller whose telephone number is (703) 308-6544. The examiner can normally be reached on Mondays through Thursdays.



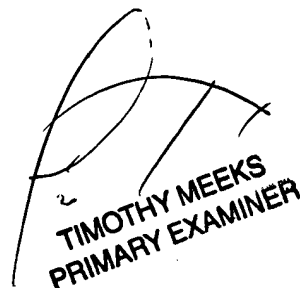
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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive Beck, can be reached at (703) 308-2333. The fax phone numbers for the organization where this application or proceeding is assigned are 703 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.



EBF  
November 12, 2002



TIMOTHY MEEKS  
PRIMARY EXAMINER